

CLAIMS

1. Apparatus for medical treatment or diagnosis in a body cavity of a mammalian subject, the apparatus comprising:
 - an elongate probe, having an outer surface and comprising a distal portion, which is adapted for insertion into the body cavity; and
 - an electrode strip, comprising:
 - an elongate insulating substrate, which is wrapped around the distal portion of the probe so as to define a helix having distal and proximal ends and a length therebetween, the substrate being fixed to the outer surface of the probe over substantially all of the length of the helix;
 - a plurality of electrodes, disposed along the length of the helix and fixed to the substrate; and
 - electrical conductors, coupled to the electrodes and running along the substrate over the length of the helix so as to communicate with circuitry in a location proximal to the distal portion of the probe.
2. The apparatus according to claim 1, wherein the distal portion of the probe is adapted to bend and comprises an elastic material, which substantially deforms due to a pressure exerted thereon by the electrode strip when the distal portion is bent.
3. The apparatus according to claim 2, wherein the electrode strip is substantially inelastic, so that the electrode strip does not substantially deform due to a tensile force exerted thereon when the distal portion is bent.
4. The apparatus according to claim 3, and comprising a glue applied between the substrate and the outer surface of the probe so as to fix the substrate to the probe, wherein the glue is sufficiently elastic so as to accommodate a relative motion between the electrode strip and the outer surface when the distal portion is bent.
5. The apparatus according to claim 1, wherein the substrate comprises a flexible circuit substrate, and wherein the electrodes and conductors are printed on the substrate by a printed circuit fabrication process.

6. The apparatus according to claim 5, wherein the substrate has an inner side, which is fixed to the outer surface of the probe, and an outer side, upon which the electrodes are disposed, and wherein the conductors are disposed along the inner side of the substrate.
7. The apparatus according to claim 5, wherein the substrate has an inner side, which is fixed to the outer surface of the probe, and an outer side, upon which the electrodes are disposed, and wherein the conductors are disposed along the outer side of the substrate.
8. The apparatus according to claim 1, wherein the probe comprises a cable passing therethrough in communication with the circuitry, and wherein the conductors are coupled to the cable at the proximal end of the helix.
9. The apparatus according to claim 7, wherein the probe comprises a multiplexer, coupled between the conductors and the cable so as to select the electrodes to be coupled to the cable.
10. The apparatus according to claim 1, wherein the electrodes are spaced substantially evenly over the length of the helix.
11. The apparatus according to claim 1, wherein the electrodes are grouped in two or more clusters over the length of the helix.
12. The apparatus according to claim 1, wherein the probe comprises a catheter, which is adapted to be inserted into a chamber of a heart of the subject.
13. The apparatus according to claim 12, wherein the electrodes are adapted to sense electrical signals within a wall of the heart, and wherein the conductors are adapted to convey the signals to the circuitry.
14. The apparatus according to claim 12, wherein the electrodes are adapted to receive electrical energy from the conductors and to apply the electrical energy to a wall of the heart.

15. A method for producing a medical device, the method comprising:
 - providing an elongate probe, which is adapted for insertion into the body cavity;
 - wrapping an electrode strip around the probe so as to define a helix having distal and proximal ends and a length therebetween, the strip comprising an elongate insulating substrate having a plurality of electrodes fixed thereto and disposed along the length of the helix and further having electrical conductors, coupled to the electrodes, running along the substrate over the length of the helix so as to communicate with circuitry associated with the probe; and
 - fixing the substrate to an outer surface of the probe over substantially all of the length of the helix.
16. The method according to claim 14, wherein the probe is adapted to bend and comprises an elastic material, which substantially deforms due to a pressure exerted thereon by the electrode strip when the probe is bent.
17. The method according to claim 16, wherein the electrode strip is substantially inelastic, so that the electrode strip does not substantially deform due to a tensile force exerted thereon when the distal portion is bent.
18. The method according to claim 17, wherein fixing the substrate comprises applying a glue between the substrate and the outer surface of the probe, wherein the glue is sufficiently elastic to accommodate a relative motion between the electrode strip and the outer surface when the distal portion is bent.
19. The method according to claim 14, wherein the substrate comprises a flexible circuit substrate, and comprising printing the electrodes and conductors on the substrate by a printed circuit fabrication process.
20. The method according to claim 19, wherein printing the electrodes and conductors comprises printing the conductors on an inner side of the substrate, which is fixed to the outer surface of the probe, and printing the electrodes on an outer side of the substrate, opposite the inner side.

21. The method according to claim 19, wherein fixing the substrate comprises fixing an inner side of the substrate to the outer surface of the probe, and wherein printing the electrodes and conductors comprises printing the electrodes and conductors on an outer side of the substrate, opposite the inner side.
22. The method according to claim 14, and comprising passing a cable through the probe, and coupling the cable to the conductors at the proximal end of the helix so as to provide a connection between the electrodes and the circuitry.
23. The method according to claim 14, wherein the probe comprises a catheter, which is adapted to be inserted into a chamber of a heart of the subject.
24. A method for medical diagnosis, comprising:
inserting an elongate probe into a body cavity of a mammalian subject, the probe having an elongate insulating substrate wrapped around a distal portion of the probe so as to define a helix having distal and proximal ends and a length therebetween, the substrate being fixed to an outer surface of the probe over substantially all of the length of the helix, wherein a plurality of electrodes are disposed along the length of the helix and fixed to the substrate, and wherein electrical conductors are coupled to the electrodes and run along the substrate over the length of the helix;
disposing the probe in the body cavity so that the electrodes sense electrophysiological activity within the cavity; and
receiving and processing signals from the electrodes via the conductors.
25. The method according to claim 24, wherein inserting the elongate probe comprises inserting a catheter into a chamber of a heart of the subject.